

Bighorn National Forest Plan Revision Existing Condition Assessment

Goose

Geographic Area Assessment



**Picture of Goose Geographic Area
Black Tooth Mountain in Background**

Goose Geographic Area Existing Condition Assessment for Forest Plan Revision

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I. Preface

This is one of nine geographic area existing condition assessments that will be used in the Bighorn Forest Plan Revision to describe resources at the geographic area scale and how they relate to the existing Forest Plan. A map of the Forest Plan revision geographic areas is in the appendix. A similar assessment will be done at the Forest-wide scale, and will include numerous resources/topics:

- that are not amenable to analysis at the geographic area scale. For example, most wildlife species are not bound by geographic area boundaries, and to avoid needless repetition in the assessments, such topics will only be discussed at the Forest scale.
- where data bases are not complete or where analysis is still on going at the time the geographic area scale assessments are completed. Examples in this category are fire condition classes and timber suitability, which are expected to be completed by early 2002.

This existing condition geographic area assessment includes the portion of the Goose watershed that occurs on the Bighorn National Forest, unless noted otherwise.

There is very little information in this assessment concerning other than National Forest System land. This information will be gathered and analyzed, where appropriate, in the draft and final environmental impact statements' effects analyses.

These existing condition assessments focus on the physical and biological resources, and in some cases, human uses and resources, such as timber harvest, grazing and recreation. There will be a social and economic section in the Forest-wide existing condition assessment, and the draft and final environmental impact statements will also include the work of the social and economic analyses, which are currently being compiled by the University of Wyoming.

Despite the fact that these assessments primarily focus on the environmental effects of human uses, it must be remembered that National Forests are managed *to be used* by people. This is implicit in the laws governing National Forest management¹. Human use of the National Forests has been directed administratively since the earliest days of the Forest Service, "This force has two chief duties: to protect the reserves against fire, and to assist the people in their use."² That tradition continues to this day in the "Caring for the land and serving people" mission. While these assessments focus on the environmental effects that people are having on the resource, the point is to make sure that the uses we enjoy today are sustainable so that our children and grandchildren can continue to use and enjoy the Bighorn National Forest.

Disclaimer for GIS generated data: The Forest Service uses the most current and complete data available. GIS data and product accuracy may vary. They may be: developed from sources of differing accuracy, accurate only at certain scales, based on modeling or interpretation, incomplete while being created or revised, etc. Using GIS products for purposes other than those for which they were created, may yield inaccurate or misleading results. The Forest Service reserves the right to correct, update, modify or replace GIS products without notification. The GIS data in these documents were generated using ArcInfo 7.2.1, operating on a Unix platform, with analysis occurring between August of 2001 and January of 2002. For more information, contact the Bighorn National Forest.

¹ The Multiple Use Sustained Yield Act of 1960, the Renewable Resources Planning Act, and the National Forest Management Act, just to name a few.

² Forest Service "Use Book" of 1905.

II. Forest Plan

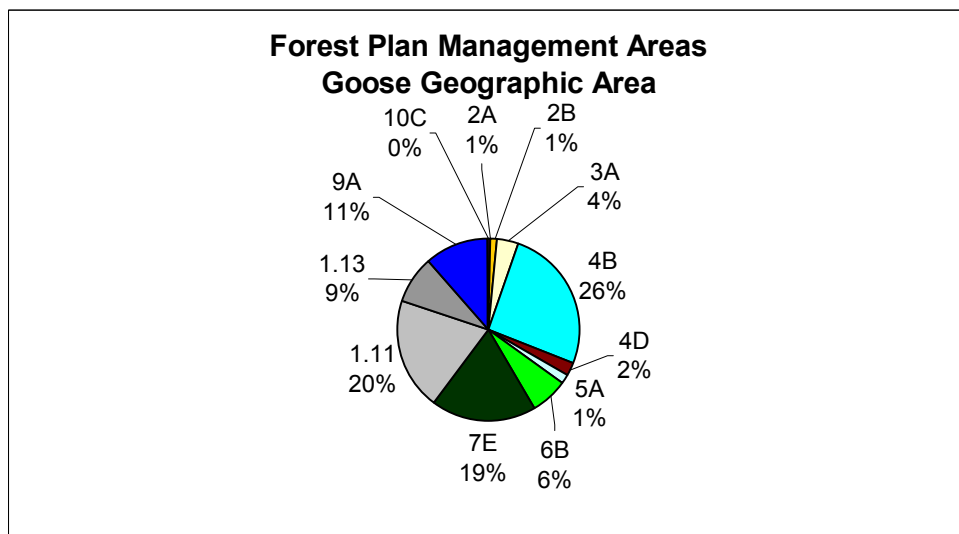
Table 1. Existing Forest Plan Management Area Allocations

Forest Plan Prescriptions	Prescription Description	GIS Acres with 9A Riparian Applied	
		Acres	%
2A	Semi-Primitive Motorized Recreation Opportunities	778	1%
2B	Rural and Roaded Natural Recreation Opportunities	1049	1%
3A	Semi-Primitive Nonmotorized Recreation Opportunities	4545	4%
4B	Wildlife Habitat Management for Management Indicator Species	29,336	26%
4D	Aspen Stand Management	2742	2%
5A	Wildlife Winter Range in Non-forested Areas	1642	1%
6B	Livestock Grazing, Maintain Forage Condition	7392	6%
7E	Wood Fiber Production	21,425	19%
1.11	Pristine Wilderness (24,681 acres with the 9A)	22,853	20%
1.13	Semi-Primitive Wilderness (11,481 with the 9A)	9915	9%
9A	Riparian and Aquatic Ecosystem Management	13,181	11%
10C	Scenic, Geologic, Historic and other Special Interest Areas	32	0%
Total		114,891	
Non-FS	The 2062 includes 918 that meet the definition of riparian area.	2062	

Some interpretations from Table 1 include:

- Wilderness is the largest allocation in this geographic area at 29%. Without 9A deducted, Wilderness would account for 31% of this geographic area.
- Next high is 26% for 4B, followed by 7E at 19%.
- Wilderness, wildlife and timber prescriptions account for 74% of this geographic area.
- Livestock grazing, 6B, is only 6% of this geographic area. This amount is comparable to Piney/Rock. This amount compares to Devil's Canyon and Shell, which have 6* allocations of 44% and 38%, respectively.

Figure 1. Existing Forest Plan Management Area Allocations



Comparison of existing condition to FP goals and objectives and standards and guidelines

- Forest Plan called for construction of the Little Goose road to Piney Creek. A February 1994 memo by the Forest Supervisor documented that after a decade of planning and public sentiment running against the road the decision on the Little Goose road would be deferred until the Revision.
- Goose Creek has the 3rd highest percentage of forested area in suited land (figure 2), but is 7th highest in terms of the percentage of suited land that has received a timber harvest stand replacing event since 1960. (Figures 4 and 5). There is a large discrepancy in amount of timber available and the amount actually harvested.

What is broken and needs to be fixed in the Forest Plan?

- The 1985 Forest Plan has a 3A management area in the Coffeen Park vicinity, while there is a road and campground in the area.
- The Forest Plan intended to close the campground, but subsequent recreation planning resulted in an updated campground closure list that removed Coffeen Park campground from the list. The change in the campground plan was never made an amendment to the Forest Plan.
- MIS species selection, modeling (elk habitat), and monitoring provisions.
- Riparian and Aspen communities forage utilization standards and guidelines.
- Road Density standards/guidelines need incorporated for elk security habitat.
- Revise the standard/guideline regarding old growth.
- Vacant allotments need consideration for bighorn sheep reintroduction.
- Fences rebuilt/constructed need to have wildlife passage considered.

What are the issues in this geographic area?

- This geographic area has the highest amount of water impoundments and water diversions.
- Big Goose and Clear Creek are municipal watersheds, and can be considered the most important watersheds as far as water quality is concerned.
- There are areas of heavy motorized use, oftentimes near and in riparian areas.
- The electronic site at Bosun Rock is recognized in the Forest Plan, but the site plan is not current.
- Riparian and aspen impacts (past and present) may be affecting wildlife habitat quality, with amphibian populations of particular concern. Less beaver than previously thought to exist, consider this species as possible MIS/Focal.
- High road density has lowered the amount of elk security habitat. This type of habitat can be an indicator for other species benefiting from less disturbance (e.g. marten).
- Protection of cave/karst resources from recreational impact.

III. Disturbance Factors

Riparian

Disturbance influences upon riparian areas are discussed in the Forest-wide assessment.

Fire

Over the long term, fire is the most dominant disturbance factor in this landscape, from the perspective of total number of acres affected. A very small percentage of fires affect a majority of the acre burned.

- Fires role is different among the major forest cover types of ponderosa pine, Douglas fir, limber pine, lodgepole pine and Engelmann spruce/subalpine fir. These are described in more detail in Knight, 2001, and will be summarized in the forest-wide assessment.
- Known fires over 1000 acres in the Goose geographic area:
 - The only fire this century over 1000 acres was a portion of the Stockwell fire, which burned in 1996. The total area covered by Stockwell was 2594 acres.
 - The origin date data shows that over 18,000 acres originated between 1870 and 1900. Based on this information and the known conditions of the Goose Creek geographic area, there was either a very large fire, or a series of fires, probably around 1870.

Insect and Disease

- Insect and disease are the second most dominant disturbance factor in this geographic area.
- Disturbance caused by insects and disease differs among the cover types present in the geographic area.
 - Limber pine only occurs along the eastern edge of the geographic area, but it is being affected by white pine blister rust. A non-native species, white pine blister rust attacks 5 needle pines, and has two hosts during its life cycle, Ribes sp. and limber pine. This is considered to be one of the most significant potential ecological impacts currently occurring on the Bighorn (Knight, 2001), as the potential is for near eradication of this species on the Forest.

Timber Harvest

Table 2 shows the amount of timber harvest and fire since the 1940s. The timber harvests are from the RIS tables, and the fire acreages are from the historic fire database.

Table 2. Timber Harvest and Fires in the Goose Analysis Area

Harvest Type	1940's	1950's	1960's	1970's	1980's	1990's	2000
Clearcut			23		18	173	
Shelterwood: Prep Cut					1351	47	
Shelterwood: Seed Cut						103	
Shelterwood: Overstory Removal					196	63	
Seed Tree							
Selection						34	
Commercial Thin						86	
Sanitation/Salvage							
Pre-commercial Thin					1079	1751	
Aspen Clearcut							

Harvest Type	1940's	1950's	1960's	1970's	1980's	1990's	2000
Fire						1000 ³	
Blowdown							
Acres CC + SW + ST + S + S/S ⁴							

Some of the insights from table 2 are:

- This is a very lightly harvested geographic area. In fact, there have only been three large timber sales in this period: Swamp Creek, Squirrel and Dome Rock.
- Precommercial thinning is the largest number of acres in this geographic area.

Tinker, et al, 1998 quantifies fragmentation caused by timber harvest and roads on the Bighorn National Forest. That analysis and conclusions are presented in the Forest wide portion of the Forest Plan Revision existing condition assessment, rather than in each geographic area discussion.

Figure 2 shows the relative amounts of suited timber by geographic area. About 40% of the Goose geographic area forested area is currently classified as suitable for timber harvest. This table could be considered an indicator of the relative amount of forested area that is *available* for timber production purposes. This is the second highest percentage, and reflects the long history of timber management emphasis in this geographic area.

Figure 2. Amount of Forested Area Available That is Suited Timber, by Geographic Area

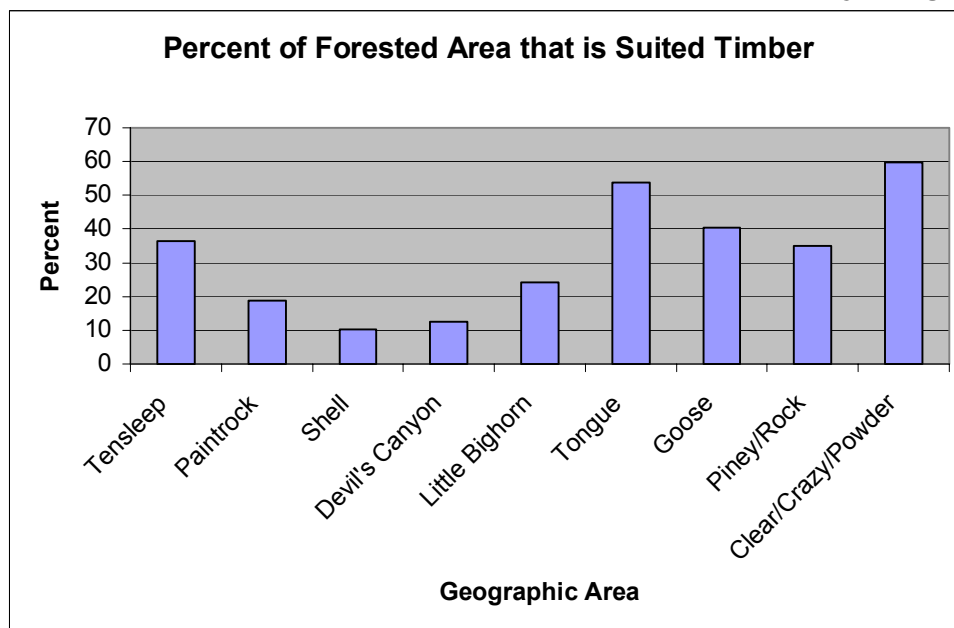


Figure 3 shows the percentage of the suited timber area that has received a final harvest (clearcut, shelterwood removal or seed cut, selection harvests) or stand-replacing fire or blowdown between 1960 and 2000. This is an indicator of the *intensity* of forest successional change, as it indicates how much of the suited land has actually had a stand-replacing event between 1960 and 2000. This is from the RIS activity database and includes the time between January 1, 1960 and February 1, 2000. Each bar is divided into “fire and blowdown” and “timber harvest” to show the relative amounts of each type of disturbance.

³ Approximate.

⁴ CC = Clearcut, SW = Shelterwood, ST = Seed Tree, S = Selection, S/S = Sanitation/Salvage. These were summed to portray the amount of sawlog harvest that has occurred.

Figure 4 shows the percentage of all forested lands that has received a final harvest (clearcut, shelterwood removal or seed cut, selection harvests) or stand-replacing fire or blowdown between 1960 and 2000. This is an indicator of the *intensity* of forest successional change, as it indicates how much of the forested area has actually had a stand-replacing event between 1960 and 2000. This is from the RIS activity database and includes the time between January 1, 1960 and February 1, 2000. Each bar is divided into “fire and blowdown” and “timber harvest” to show the relative amounts of each type of disturbance.

Figure 3. Percent of Suited Timber that Received a Stand Replacing Event, 1960-2000

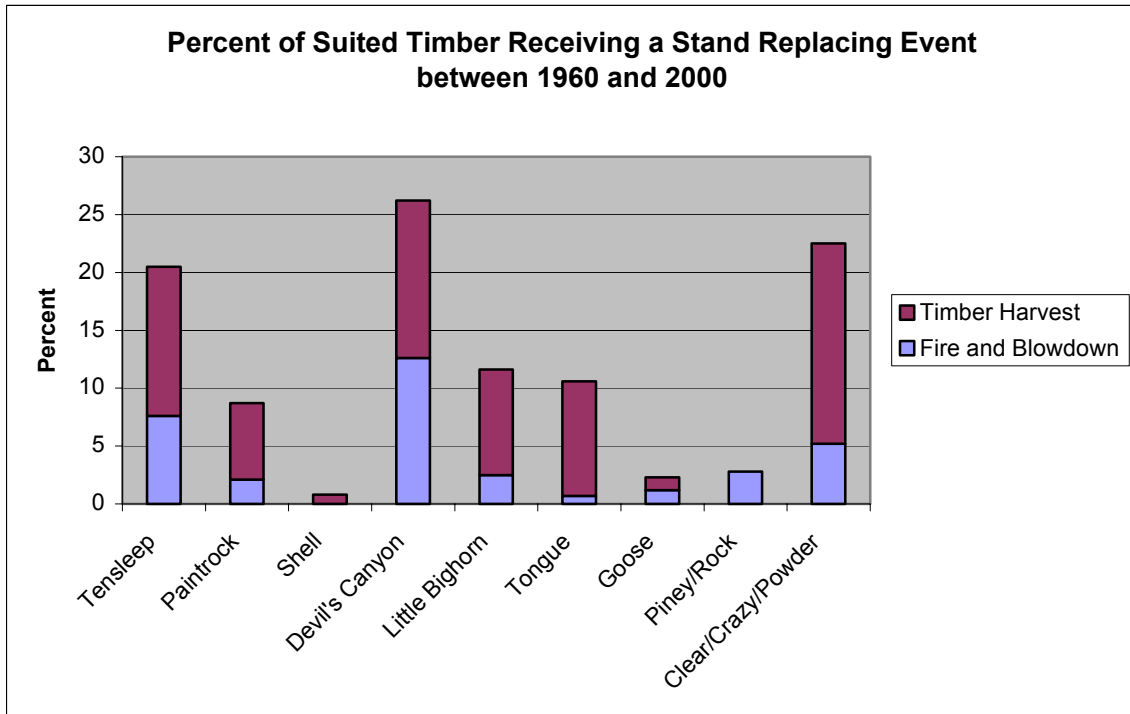
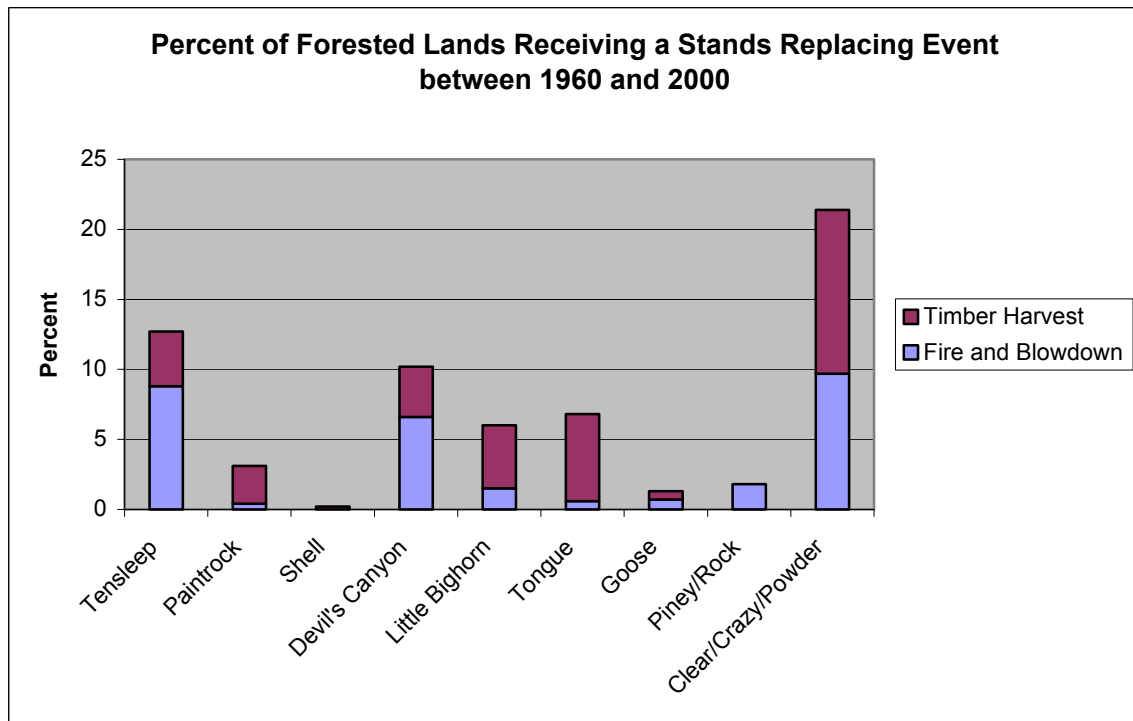


Figure 4. Percent of All Forested Lands that Received a Stand Replacing Event, 1960-2000



Exotic Species

- Forest-wide issue of non-native grass/forb seed mix for revegetation and erosion control.
- Fish: Eastern Brook trout, brown trout, golden trout, and rainbow trout are popular fishing species, but are not native to the Bighorn NF.
- Canadian thistle is among the noxious weeds known to occur in this geographic area.

IV. Geology and Geomorphology

Table 3 shows the Landtype Associations (LTAs) within the assessment area. Landtype associations are general descriptions of local geology and topography⁵. A map of the LTAs is in the appendix.

Table 3. Acres of Landtypes within Goose Geographic Area

Landtype Description	Acres	% of total
Glacial cirquelands	4,192	4
Alpine mountain slopes and ridges	17,629	15
Glacial/tertiary terrace deposits	6,400	5
Granitic mountain slopes, gentle	29,402	25
Granitic mountain slopes, steep	1,961	2
Granitic breaklands	48,555	42
Sedimentary breaklands	1,805	2
Sedimentary mountain slopes, limestone/dolomite	261	0
Sedimentary mountain slopes, shale/sandstone	6,747	6
Landslide colluvial deposits	0	0
Unclassified	0	0
Totals:	116,952	101%

The Bighorn Mountains were formed by diastrophism sometime during the Mesozoic period. They are folded mountains that have eroded on top to form what some geologists refer to as a partial peneplain. The highest point in the geographic area is a peak above Cross Creek Lake (11,760 feet). The lowest point within the forest boundary is where Little Goose Creek meets the forest boundary at 4,840 feet.

The area around Moncreiff Cliffs is much younger in age than is the main North-South Bighorn chain. The portion of the Bighorns south of the town of Big Horn, Wyoming was formed by faulting, the Moncreiff Cliffs then being a fault scarp and the uplifted side of the fault.

Erosion has exposed the uplifted beds on the east and west faces of the Bighorn Mountains. There are five major formations on the flanks of the mountains. However, the formations are not as extensive as they are on either the north or south end of the Bighorn chain.

The Tensleep formation of the Pennsylvanian age forms steep dip slopes along most of the mountain flank. The formation is dominantly a resistant cross-bedded sandstone with minor amounts of dolomite. It is probably conformable with the Amsden formation.

The Amsden formation of the Pennsylvanian age consists of cherty dolomite, red sandstone, and red and purple shale. The formation was deposited upon the eroded surface of rocks of the Mississippian age. The formation weathers to form the red slopes between resistant Tensleep and Madison formations.

⁵ Landtype associations are groupings of landtypes or subdivisions of subsections based upon similarities in geomorphic process, geologic rock types, soil complexes, stream types, lakes, wetlands, and plant association vegetation communities. Names are often derived from geomorphic history and vegetation community. Avers, et al, 1993. See also Table 3, Chapter 1, for hierarchical location of landtype associations.

The Madison formation is of early and Late Mississippian age and is exposed as a series of ledges formed by resistant beds. Caverns are typical especially in the upper part of the formation. The formation is composed of dolomitic limestone, limestone and dolomite.

The Bighorn dolomite of late Ordovician age is about 500 feet thick which is divided into three units. The basal sandstone is about 30 feet thick in Sheridan County, consisting of cross-bedded friable white sandstone. The middle unit is about 280 feet thick is a massive dolomite that weathers to a characteristically rough pitted surface. The upper unit consists of a thin-bedded dolomite, limestone, and dolomitic limestone. The core is of igneous origin from Ordovician to Precambrian age.

The Goose Creek geographic area has been extensively glaciated. The Wisconsin glaciation period has markedly influenced over half of the geographic area. Terminal moraines, potholes, cirques, lateral moraines, recessional moraines, and rock striations are common. All man-made reservoirs are located in the glaciated portion of the geographic area.

Geologic Hazards

The landslide map used in this analysis was created from 1:24,000 scale maps obtained from the Wyoming State Geological Survey office in Laramie, WY. Within the Goose geographic area there are 585 acres of soils prone to landslides. The areas subject to slides are widely distributed in small units throughout the geographic area. Most of the landslide prone lands are located on limestone geologies.

Table 4. Landslide Prone Acres

Geographic Area Name	Acres of Soils Prone to Landslides
Goose Geographic Area	585

Erodibility

There are approximately 4,313 acres of soils within the Goose watershed classified as having a severe risk for erosion. Ground disturbing activities on these soils would increase the risk of generating erosion from these areas.

Table 5. Acres of Erodible Geology

Geographic Area Name	Acres of Erodible Geology
Goose Geographic Area	4,313

Mineral resources

A detailed minerals report for this area does not exist at this time. Minerals information for this area will be incorporated into the Forest-wide assessment.

Hydrologic Disturbance factors

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

V. Soils and Topography

Soils in the geographic area are shallow in depth; in many areas they are less than 12 inches thick. The sedimentary parent material produces a soil that is heavier in texture than the granitic soils. The soil pH ranges from 6.0 to 7.5 in this area. Rooting has occurred throughout all horizons on the granitic soils. Texture on the non-glaciated granitic portion of the geographic area is sandy loam to loam. The pH varies from 5.6 to 6.5, the majority of the soil having a pH of 6.0. The residual soil has a depth of approximately 25 inches, with the B-horizon having a coarser texture than the A-horizon.

Table 6 shows the soil types that occur in the Goose geographic area and the amount of the analysis area comprised of each soil type. A description of each soil type can be found in the Project File. Forage production is displayed in Table 6 as a way to display the natural range of soil productivity within the analysis area (Nesser, 1976).

Table 6. Acres of Various Soil Types within the Goose Geographic Area

Soil Identification Number ⁶	Acres	Productivity as Measured by Forage Production (#/acre)
10	29,517	500-700
11	23,076	500-700
12	0	600-800
13	2,174	Na
14	451	500-700
15	1,454	500-1,800
16	1,643	3,000-3,500
17	0	
18	801	1,500-1,800
19 A and B	10,953	500-700
21	0	1,500-1,800
22	43	1,200-1,700
23	0	1,500-1,800
24	0	1,600-2,400
25	3,240	1,500-1,800
26	229	600-1700
27	258	1,600-2,400
29	1,309	1,600-2,400
30	0	1,600-2,400
31	4,917	500-700
32	0	500-700
33	9,963	600-800
36	0	500-800
37	0	Na
38	0	500-700
39	0	600-1,700
40	0	500-700
41 A and B	0	1,500-1,800
43	0	500-700
Water	1,077	Na

⁶ Descriptions of soil types and their management interpretations can be found in "Soil Survey of Bighorn National Forest, Wyoming". U.S.D.A. Forest Service, 1986.

Erosional processes

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

Range of variability in soil conditions

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

Risk to soil resources including soil loss or compaction

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

VI. Hydrology and Water Quality

The Goose Creek watershed is a tributary to the Tongue watershed. The two watersheds join several miles below the forest boundary. The Goose geographic area consists of two main tributaries: the Big and Little Goose watersheds. Table 7 lists the major watersheds within the planning area.

The Goose geographic area has a total of 150 miles of perennial streams along with 282 miles of intermittent. Drainage efficiency is the most important factor in determining the time it takes precipitation to become runoff. Lag time is the time it takes water to concentrate at a certain point on the watershed after precipitation occurs. Lag time at the mouth of Big Goose Creek is 8.6 hours. The fall of the main stem of Big Goose Creek is 420 feet per mile.

Table 7. 6th Field Watershed Data within Planning Area

6th Field Watershed Name	6th Field Watershed Number	Perennial Stream Miles	Intermittent Stream Miles	FS WS Acres	Other WS Acres	Total WS Acres
Cross Creek above Bighorn Reservoir	100901010101	3	10	5,756	0	5,756
East Fork Big Goose above Park Reservoir	100901010102	15	22	12,923	0	12,923
East and West Fork Big Goose above Beckton	100901010103	81	136	58,316	1686	60,002
Little Goose above Bighorn, WY	100901010104	38	75	30,100	177	30,277
Little Goose at Bighorn, WY	100901010105	2	6	1,623	39	1,662
Big Goose (and Rapid Creek) above Sheridan, WY	100901010106	9	32	7,315	27	7,342
Soldier Creek above Sheridan, WY	100901010107	2	1	920	132	1,052
Totals:		150	282	116,953	2,061	119,014

Water Rights

Total water appropriated by the State of Wyoming to water users in the Sheridan valley is in the neighborhood of 433,567 acre-feet per year. The Goose geographic area on the National Forest produces 102,950 acre-feet per year on 175 square miles. Total water production of Big and Little Goose Creeks is 130,300 acre-feet at Sheridan.

Water Quality and Water Uses

Historically, the water quality in the Big and Little Goose watersheds (within the forest boundary) has been good. Personal communication with the conservation district shows that there are

currently no water quality standards being violated within the Goose Creek geographic area in the forest boundary.

Table 8. Wyoming Surface Water Quality Classifications (2001) and Domestic Water Users

Watershed	Wyoming Surface Water Quality Class	Tributaries	Wyoming Surface Water Quality Class	Community Water System being Served
Big Goose Creek			2AB	City of Sheridan VA Medical Center
		Soldier Creek	2AB	
		Beaver Creek	3B	
		Rapid Creek	2AB	
		East Fork Big Goose Creek	2AB	
		Babione Creek	2AB	
		Edelman Creek	2AB	
		Cross Creek	2AB	
		West Fork Goose Creek	2AB	
		Coney Creek	2AB	
Little Goose Creek			2AB	
		West Fork Little Goose Creek	2AB	
		East Fork Little Goose Creek	2AB	

All streams within the analysis area (except Beaver Creek which is 3B) are classified as Class 2AB.

Class 2, Fisheries and Drinking Waters. Class 2 waters are waters that are known to support fish or drinking water supplies or where those uses are attainable. Class 2 waters may be perennial, intermittent or ephemeral and are protected for the uses indicated in each sub-category. There are four sub-categories of Class 2 waters. Class 2AB waters are those known to support game fish populations or spawning and nursery areas at least seasonally and all their perennial tributaries and adjacent wetlands and where a game fishery and drinking water use is otherwise attainable.

Class 3, Aquatic Life other than Fish. Class 3 waters are waters that do not support nor have the potential to support fish populations or spawning, or certain perennial water that lack the natural water quality to support fish. Class 3B waters are tributary waters that are not known to support fish populations or drinking water supplies and where those uses are not attainable. In general, 3B waters are characterized by frequent linear wetland occurrences or impoundments within or adjacent to the stream channel over its entire length.

In 2000, the State conducted a review of all watersheds within the State to determine whether or not they are meeting the designated beneficial uses (i.e., fisheries, recreational use, etc.). The results of that review can be found in the document titled, "Wyoming 2000 305(b) State Water Quality Assessment Report". Table 9 summarizes the watersheds within this analysis area listed in the State 2000 305(b) report.

Big Goose and Little Goose Creeks were placed on the 1998-303(d) list due to exceedences of the standard for fecal coliform bacteria below the forest boundary. Subsequent monitoring by

Wyoming Department of Environmental Quality (WDEQ) in 1998 and 1999 revealed exceedences in several other locations in these watersheds (Kruse Creek, Sacket Creek, and Jackson Creek irrigation canal-tributaries of Little Goose Creek; Beaver Creek, Park Creek, and Rapid Creek-tributaries of Big Goose Creek), as well as in Goose Creek and a tributary, Soldier Creek. All these streams are on the 2000 303(d) list. Sheridan County Conservation District has started a project to determine the sources of fecal contamination in these watersheds and begin locally led efforts to mitigate those sources.

Table 9. Water Quality Impaired Watersheds (2000)

Watershed	Listed on 2000 State 305(b) Report?	Type of Listing (Impaired or Threatened)	Reason for Listing and Location of Impairment
Beaver Creek	Y	Impaired	Impaired from Big Goose Creek to an unknown distance upstream. Fecal contamination.
Big Goose Creek	Y	Impaired	Impairment from Sheridan to above Beckton. Fecal contamination.
Goose Creek	Y	Impaired	Unknown distance below Sheridan waste water treatment plant. Fecal contamination.
Jackson Creek	Y	Impaired	Impairment from Little Goose Creek to an unknown distance upstream. Fecal contamination.
Kruse Creek	Y	Impaired	Impairment from Little Goose Creek to an unknown distance upstream. Fecal contamination.
Little Goose Creek	Y	Impaired	Impairment from Sheridan to above Big Horn, WY. Fecal contamination.
Park Creek	Y	Impaired	Impairment from Big Goose Creek to an unknown distance upstream. Fecal contamination.
Rapid Creek	Y	Impaired	Impairment from Big Goose Creek to an unknown distance upstream. Fecal contamination.
Sacket Creek	Y	Impaired	Impairment from Little Goose Creek to an unknown distance upstream.
Soldier Creek	Y	Impaired	Impairment from Goose Creek to an unknown distance upstream. Fecal contamination.

Human Impacts Upon Water Quality

Influence of Timber Harvesting upon Water Quality

Timber harvest activities are one of the major land management activities within the analysis area. The mechanical processes involved in timber harvest and associated road construction, in conjunction with natural conditions, influence the level of disturbance within geographic areas. Negative effects tend to increase when activities occur on environmentally sensitive terrain with steep slopes composed of highly erodible soils that are subject to high climatic stresses.

Soil and site disturbance that inevitably occur during timber harvest activities are often responsible for increased rates of erosion and sedimentation, modification and destruction of terrestrial and aquatic habitats, changes in water quality and quantity, and perturbation of nutrient cycles within aquatic ecosystems. Physical changes affect runoff events, bank stability, sediment supply, large woody debris retention, and energy relationships involving temperature. All of these changes can eventually culminate in the loss of biodiversity within a geographic area.

Increased delivery of sediments, especially fine sediments, is usually associated with timber harvesting and road construction. As the deposition of fine sediments in salmonid spawning habitat increase, mortality of embryos, alevens, and fry rises. Erosion potential is greatly increased

by reduction in vegetation, compaction of soils, and disruption of natural surface and subsurface drainage patterns. Generally, logged slopes contribute sediment to streams based on the amount of bare compacted soils that are exposed to rainfall and runoff. Slope steepness and proximity to channels determine the rate of sediment delivery.

Research by Troendle, et al (1998), shows that when approximately 24% or more of the basal area of a watershed is removed, peak flows (instantaneous maximum flow or maximum mean daily flow) were not significantly increased. However, the duration of the higher, near bankfull discharges were extended.

Table 10 gives the acres of treatment followed by the equivalent clearcut acres for that treatment. An equivalent clearcut acre is roughly equal to the basal area removal for a given harvest type. For example, a shelterwood prep-cut removes approximately 33% of the basal area in a treated stand. The ECA for that prescription is 0.33.

Table 10. Equivalent Clearcut Acres for Goose Geographic Area

Harvest Type	Equivalent Clearcut Multiplier	1950's	1960's	1970's	1980's	1990's	2000	Totals
Clearcut (acres) (ECA)	1.00		23 23		18 18	173 173		214
Shelterwood: Prep Cut (acres) (ECA)	0.33				1351 446	47 16		462
Shelterwood: Seed Cut (acres) (ECA)	0.33					103 34		34
Shelterwood: Overstory Removal (acres) (ECA)	1.00				196 196	63 63		259
Seed Tree (acres) (ECA)	0.85							
Selection (acres) (ECA)	0.35					34 12		12
Commercial Thin (acres) (ECA)	0.35					86 30		30
Sanitation/Salvage (acres) (ECA)	0.35							
Pre-commercial Thin (acres) (ECA)	0.20				1079 216	1751 350		566
Aspen Clearcut (acres) (ECA)	1.00							
Fire (acres) (ECA)	1.00					1000 1000		1000

Harvest Type	Equivalent Clearcut Multiplier	1950's	1960's	1970's	1980's	1990's	2000	Totals
Blowdown (acres) (ECA)	1.00							
TOTAL ECA % of Area⁷								2577 2%

As shown in Table 10, approximately 2% of the geographic area is in an ECA condition. In reality, this number would be somewhat less than 2% due to vegetation recovery following fire or timber removal. However, given this worst-case scenario, timber management combined with natural wildfire has probably not exceeded the range of variability in vegetation removal in this geographic area.

Influence of Roads upon Water Quality

Roads contribute more sediment to streams than any other land management activity, but most land management activities such as mining, timber harvest, grazing, recreation, and water diversions are dependant on roads. The majority of sediment from timber harvest activities is related to roads and road construction and associated increased erosion rates. Serious degradation of fish habitat has been shown to result from poorly planned, designed, located, constructed, or maintained roads.

Road/stream crossings can also be a major source of sediment to streams resulting from channel fill around culverts and subsequent road crossing failures. Plugged culverts and fill slope failures are frequent and often lead to catastrophic increases in stream channel sediment, especially on old abandoned or unmaintained roads. Unnatural channel widths, slope, and streambed form occur upstream and downstream of stream crossings, and these alterations in channel morphology may persist for long periods of time. Channelized stream sections resulting from rip-rapping of roads adjacent to stream channels are directly affected by sediment from side casting, snow removal, and road grading; such activities can trigger fill slope erosions and failure. Because improper culverts can reduce or eliminate fish passage, road crossings are a common migration barrier to fishes.

Table 11. Number of Stream Crossings in Planning Area

Watershed	No. of Stream Crossings	No. of Stream Crossings/Square Mile
Cross Creek	1	2.00
East Fork Big Goose above Park Reservoir	3	1.27
East and West Fork Big Goose above Beckton	47	0.65
Little Goose above Big Horn	36	1.00
Big Goose (and Rapid Creek) above Sheridan	21	1.84

⁷ This number does not account for vegetation recovery over time. Following fire or timber harvest, trees will reestablish themselves on a site and the ECA for that activity will approach zero. Therefore, the ECA's for this watershed will probably be somewhat less than suggested by this table. Also, roads were not included in this table at this time. Roads add approximately 4 acres of ECA per mile.

Roads in the analysis area directly affect natural sediment and hydrologic regimes by altering stream flow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition, stream temperatures, water quality, and riparian conditions within a watershed. Road related mass movements can continue for decades after the roads have been constructed. Such habitat alterations can adversely affect all life-stages of fishes, including migration, spawning, incubation, emergence, and rearing.

Field inventories have shown that the amount of watershed risk presented by roads in the analysis area is directly related to maintenance level. The lower maintenance level roads tend to be more susceptible to yearly input of sediment into nearby streams. Table 12 displays the existing miles of road by maintenance level in the analysis area. This number will be used to compare watersheds at highest risk for road related watershed impacts.

Table 12. Miles of Forest Service Roads in the Geographic Area

Maintenance Level	Miles of road within the Geographic Area	Overall Condition and Watershed Risk
Unclassified	6	Roads in this category are generally user-created. They are not designed to prevent watershed impacts. They tend to be used seasonally to access recreation areas. No maintenance occurs on these roads. Watershed impacts can occur when these roads are near water bodies. However, limited use reduces the risk to water quality.
Level 1	27	These roads are generally not open to the public. They are closed except for administrative purposes. Watershed impacts tend to vary with the amount of use.
Level 2	63	These roads tend to be native surface roads with poor drainage design. During wet seasons, rutting frequently occurs. Stream crossings are generally a source of sediment. These roads pose the highest risk to water quality due to their frequent use, number of stream crossings, and low standard design.
Level 3	13	These roads are generally designed with good road drainage and maintained on a regular basis. These roads tend to be in-sloped with a ditch and have a gravel surface. They usually do not pose a serious threat to water quality.

Influence of General Recreational Activities upon Water Quality

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

Reservoirs and Impoundments

The Goose Creek geographic area has been highly altered by reservoirs, diversions, and ditches. The water produced in this geographic area is used for domestic drinking water for the town of Sheridan, Wyoming and for irrigation in Sheridan County. The following summary lists the existing reservoirs and ditches within the Goose geographic area.

Little Goose Watershed

Little Goose has a drainage area of 55 square miles, contains five storage reservoirs and three irrigation ditches which bring water into the drainage. These reservoirs maintain stream flow above

average thru the months of July, August, and September. Between September and October the irrigation season diminishes and stream flow drops 25-30 cfs.

- West Fork Little Goose Creek – Willits ditch diverts water from the West Fork of Little Goose Creek to Willits Reservoir on Willow Creek.
- East Fork Little Goose Creek – The East Fork of Little Goose Creek begins in the Cloud Peak wilderness and flows northeast where it joins with the West Fork Little Goose one mile inside the forest boundary. There are no existing reservoirs or ditches on this fork.
- Last Chance Reservoir – This is the smallest reservoir on the forest (65 acre-foot capacity). The reservoir is filled from two sources, Bighorn Reservoir and the headwaters of Willow Creek. Most of the water to fill this reservoir comes from Bighorn Reservoir, through Cross, Cruise, and Last Chance ditch.
- Martin Reservoir – The appropriation for this reservoir is from Cross Creek. Martin reservoir is filled via Last Chance reservoir. The capacity for this reservoir is 568 acre-feet. The capacity of the ditch between Last Chance and Martin reservoir is 19 cfs. The principal spillway of Martin reservoir is located in Willow Creek. There is no provision for a minimum pool in Martin Reservoir or a sustained flow in Willow Creek. Below Martin reservoir the creek has been devastated by a reservoir failure sometime during 1913-1914.
- Park Reservoir Ditch and Peralto Ditch – These ditches import water into Willow Creek and the Little Goose drainage. Willow Creek has not eroded significantly with the additional diversions. Since the failure of the Willow Reservoir in June 1968, the channel in both Willow Creek and Little Goose Creek has been extensively altered.

Big Goose Watershed

There are thirteen existing reservoirs above the gage as well as six irrigation ditches that divert water from Big Goose to Little Goose and Rapid Creeks. Storage reservoirs and mid-summer releases have aided in maintaining a more uniform flow in Big Goose Creek.

- West Fork Big Goose Creek – The West Fork of Big Goose Creek originates in the Cloud Peak wilderness. The West Fork of Big Goose Creek contributes 30% of the total runoff to the flow of Big Goose Creek. This is important because the West Fork only has 20% of the watershed area of Big Goose Creek. The creek flow unimpeded for five miles where it enters Upper Dome Lake reservoir. Storage in Upper Dome Lake Reservoir and Dome Lake reservoir and Dome Lake Reservoir #1 totals 1,843 acre-feet.
- Twin Lakes #1 and #2 – The third major tributary to of the West Fork of Big Goose Creek is Coney Creek. Twin Lake #1 and #2 reservoirs are located in this watershed. These reservoirs are part of the City of Sheridan's water supply.
- Sawmill Reservoir – Sawmill Creek is a tributary of the West Fork Big Goose watershed. Sawmill reservoir is located on Sawmill Creek north of the Sawmill Lakes.
- Big Goose and Beaver Ditch – This ditch diverts water from the East Fork Big Goose Creek and places it in the headwaters of Rapid Creek. There are fourteen ditches below the forest boundary that divert Rapid Creek water. The headwaters of Rapid Creek are still downcutting because of the diversion. The erosive action is not as prominent as it has been in the past.
- East Fork Big Goose Creek – This drainage originates six miles into the Cloud Peak wilderness and flows north to its junction with Cross Creek above Park reservoir. There are no impoundments or diversions on this section of stream. This reach of stream is the only easily accessible major fishing stream unaffected by impoundments or diversions.
- Cross Creek Reservoir – This reservoir is located on Cross Creek less than a mile from the Cloud Peak wilderness boundary. Below Cross Creek, water can be put into the Cross, Cruise and Last Chance ditch or can be carried via Cross Creek to the East Fork of Big Goose Creek.
- Bighorn Reservoir – This is located on Cross Creek below Cross Creek reservoir.

- Granger Reservoir – This reservoir has a capacity of 73 acre-feet and is filled via the Peralto Ditch.
- Park Reservoir – This reservoir is located on the main stem of the East Fork of Big Goose Creek.
- Weston Reservoir – This reservoir is the only one located on Babione Creek. Portions of the water rights on Babione Creek are used on land riparian to Rapid Creek. To put the appropriated water in Rapid Creek requires the use of two ditches, Antler-Babione Ditch and the Big Goose and Beaver Ditch. The Antler-Babione ditch is used to place water in the East fork above the Big Goose and Beaver Ditch. The Big Goose and Beaver Ditch transports water from the West Fork Gig Goose Creek to Rapid Creek.

Hydrographs have been developed for the major streams within the Goose Creek geographic area. However, they are subject to variation because of the number of reservoirs and irrigation diversions on the drainage. All five hydrographs are similar in that they have their minimum flow regime during the months of January and February. A two-month average gives a good indication as to the minimum flow available for fisheries. Peak flow occurs between May 10 and June 28. The five streams, in most years, peak within three days of one another.

A stream gage is located in Cross Creek above Bighorn Reservoir. The installation of Cross Creek reservoir has decreased the flow extremes approximately 50%. A slope change in the recession limb of the hydrograph indicates that reservoir releases have added to the base stream flow during the months of August, September, and October. Between October and November stream flow returns to normal.

The stream gage on the East Fork Big Goose Creek drains an area of 20.3 square miles. The station is located above the junction of Cross Creek and the East Fork of Big Goose Creek. There are no diversions above the gage. Minimum average streamflow, (2.7 cfs) occurs during the months of February and March. Maximum discharge of 1,230 cfs occurred on June 15, 1963.

A stream gage was installed on the West Fork Big Goose Creek in 1954. This gage is located on the West Fork about 300 feet below the Big Goose road. Above the gage the drainage area is 24.4 square miles. Above this gage, there are four existing reservoirs. They are Dome Lake, Dome Lake reservoir, and Twin Lakes #1 and #2. Maximum discharge for this stream was 1,030 cfs that occurred on June 15, 1963 while the minimum was 0.8 cfs on December 14, 1963. Reservoir releases from the exiting reservoirs have maintained a fairly constant stream flow during August and September.

The Big Goose Creek stream gage is located just outside the Forest boundary on the T-T Ranch, and measures a 120 square mile drainage area.

Wetlands/Riparian Areas

Table 13 shows the acres of riparian area within the watershed, and a map of the riparian areas is in the appendix. Riparian areas are defined in management prescription area 9A of the 1985 Forest Plan, page III-198:

“The aquatic ecosystem, the riparian ecosystem (characterized by distinct vegetation), and adjacent ecosystems that remain within approximately 100 ft. measure horizontally from both edges of all perennial streams and from the shores of lakes and other still waters bodies.”

Table 13. Acres of Riparian within Geographic Area

6th Field Watershed Name	6th Field Watershed Number	Acres of Riparian	Miles of Road within Riparian
Cross Creek above Bighorn Reservoir	100901010101	623	0.92
East Fork Big Goose above Park Reservoir	100901010102	1286	11.08
East and West Fork Big Goose above Beckton	100901010103	8548	0
Little Goose above Bighorn, WY	100901010104	2684	2.02
Little Goose at Bighorn, WY	100901010105	114	0
Big Goose (and Rapid Creek) above Sheridan, WY	100901010106	707	1.58
Soldier Creek above Sheridan, WY	100901010107	43	0
Totals:		14,005	16

At the time of the 1985 Forest Plan, only a few of the larger riparian areas were mapped. Since then, the riparian mapping project defined areas of riparian vegetation, and Geographic Information Systems (GIS) were developed, making the mapping of riparian areas feasible. The riparian mapping project on the Bighorn was completed in about 1995. The project consisted of using 1992 color infrared, 1:24,000 scale, aerial photography to map riparian areas based upon a combination of the riparian vegetation and the stream course geomorphology and topography.

Riparian vegetation has a moderate influence on water yield due to evapotranspiration rates associated with riparian species. Since evapotranspiration rates are highest during periods of highest runoff, the effect of riparian vegetation on the timing of water yield is only moderate. Riparian vegetation is extremely important for control of sediment from upslope sources during high runoff/surface erosion periods. Riparian vegetation is also critical for the stability of lower gradient stream reaches.

VII. Aquatic Species and Their Habitat

Aquatic Species Habitats

Streams in the analysis area support a diverse assemblage of fish species. Based on electro-fishing evaluations, conducted by the Wyoming Game and Fish Department (WGFD) and BNF personnel, between 1983 and 2000, brook trout (BKT), brown trout (BNT), rainbow trout (RBT), and cutthroat trout (CUT) are present in the analysis area however, there is limited information on the distribution and concentration of fish in the analysis area.

Sensitive Species

The Tongue River Basin (of which the Goose Creek geographic area is a part of) is within the historic eastern edge of pre - Columbian Yellowstone Cutthroat trout distribution (Behnke 1992). Although the Tongue River falls within the historic range of Yellowstone cutthroat trout (Varley and Gresswell, 1988), there is little evidence that native populations exist in the analysis area today. Now the vast majority of sport fishing in the basin is for introduced Salmonid species.

Habitat Information

The Forest has not completed an aquatic inventory on the Goose Creek geographic area. This information will be collected within the next several years.

Natural and human causes of change affecting aquatic life

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

Influence of Non-Native Fish Species Introductions

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

Influence of Aquatic Habitat Fragmentation and Simplification

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

VIII. Air Quality and Visibility

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

IX. Climate

This topic is relevant at the Forest-scale and is discussed in the Forest-wide assessment.

X. Vegetation

Composition, distribution, and abundance of the major vegetation types and successional stages of forest and grassland systems

Figure 5 shows the major vegetation cover types that occur in the Goose geographic area. Non-vegetation includes rock and bare areas.

Figure 5. Vegetation Cover Types in the Goose area.

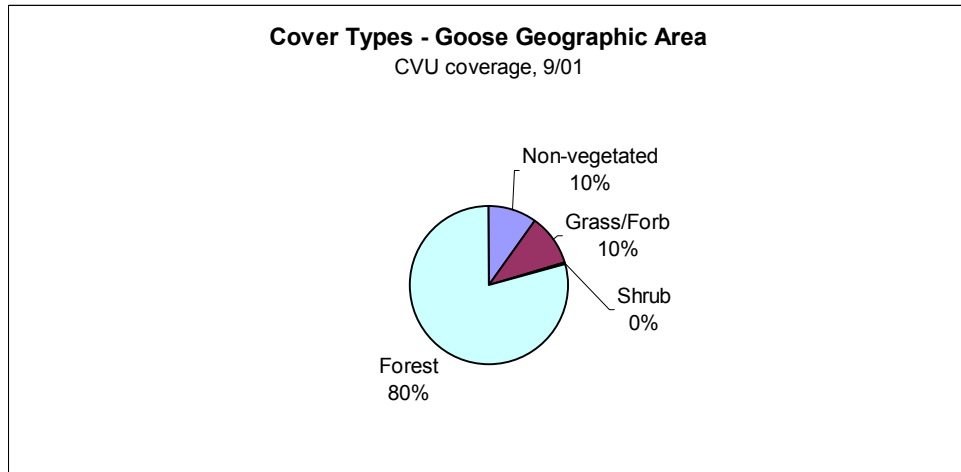
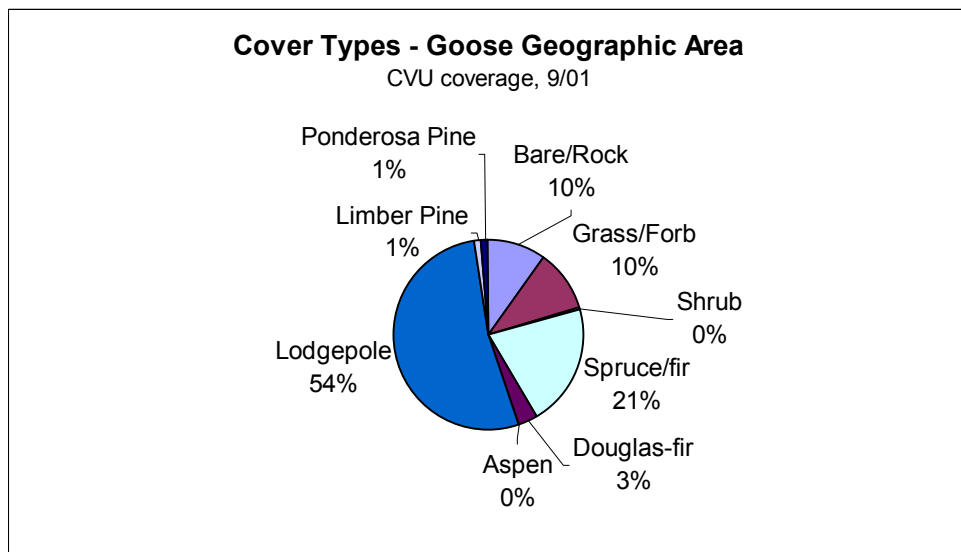


Figure 6 shows the relative amounts of the dominant cover types. Other species exist in the geographic area, but were not of sufficient size and scale to be the dominant cover type in a common vegetation unit polygon.

Figure 6. Vegetation Cover Types in the Goose area.



The origin dates chart, figure 7, shows the stand origin dates for the forested stands in the assessment area. This data is either from the Stage II point information, or origin years were assigned to stands that regenerated after harvests or fires. Some of the major disturbance events can be seen in this chart:

- The largest spike, centered on about 1885, represents the large fire that occurred in this geographic area around 1870.

Figure 7. Forested Stand Origin Dates in the Goose area

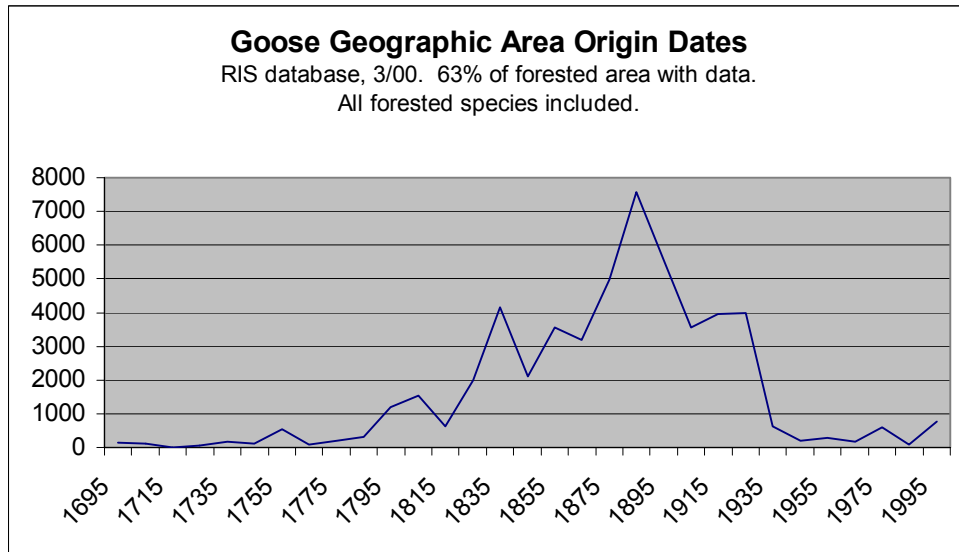


Figure 8 shows the habitat structural stages for the forests in the geographic area. Habitat structural stage provides a “coarse filter” look at habitats provided by forests in the geographic area. It gives an indication of forest size and density, which can be interpreted for wildlife habitat suitability. Forested stands provide an infinite variety of tree sizes and canopy densities, and to consider the amount, type, and spatial distribution of wildlife habitats, people need a simplified system to comprehend this variety. Many habitat considerations, such as amount and type of understory vegetation; size and amount of snags and coarse woody debris; and, the amount of hiding cover provided, can be approximately inferred from the broad habitat groupings described in the habitat structural stage model.

Habitat structural stages are defined in Hoover and Wills (1987). Structural stages describe the developmental stages of tree stands in terms of tree size and the extent of canopy closure. Structural stages can be considered a descriptor of the succession of a forested stand from regeneration, or bare ground, to maturity. For the purposes of a describing wildlife habitat, forest structural stages are divided into four categories, consisting of Stage 1, grass/forb; Stage 2, shrub/seedling; Stage 3, sapling/pole; and Stage 4, mature, Table 14.

It is important to recognize that structural stages represent succession in *forested stands* only; the grass/forb, structural stage 1, refers only to forested stands that have undergone a stand-replacing event, and are temporarily in a “non-forested” condition. Structural Stage 1 does not include naturally occurring meadows. The Structural Stage 1 areas are shown on the transitory forest cover type map in the appendix. These areas do not have a forested cover type in the CVU database, but they are areas that were either recently burned or harvested and have a current cover type of grass, forb, bare, wood, etc. The letter in the structural stage naming convention (a, b, or c) refers to the crown density, Table 14.

Figure 8. Habitat Structural Stages in the Goose Geographic Area

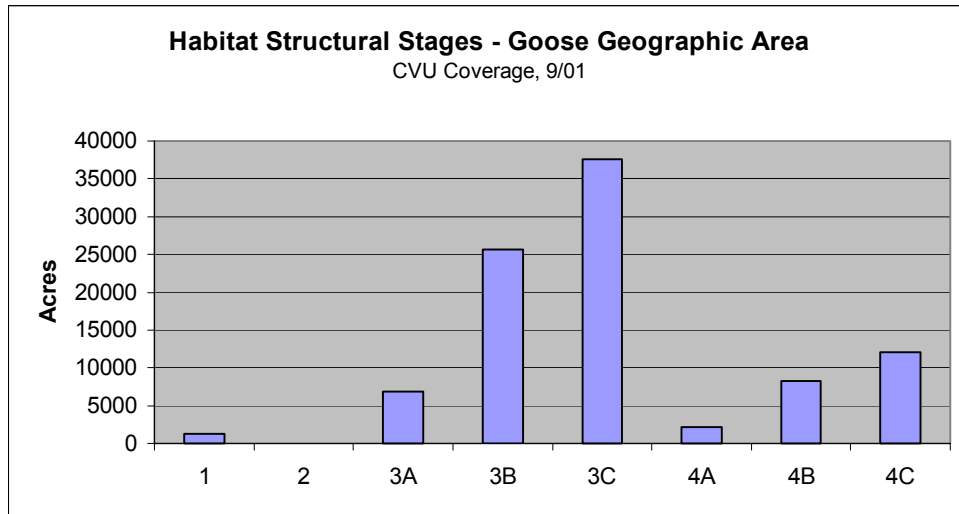


Table 14. Habitat Structural Stage Definitions, Hoover and Wills 1987

Habitat Structural Stage	Diameter	Crown Cover %	Habitat Structural Stage	Diameter	Crown Cover %
1	Not applicable	0-10%	3C	1 – 9 inches	70-100%
2	< 1 inch	10-100%	4A	9+ inches	10-40%
3A	1 – 9 inches	10-40%	4B	9+ inches	40-70%
3B	1 – 9 inches	40-70%	4C	9+ inches	70-100%

Interpretations from this table are:

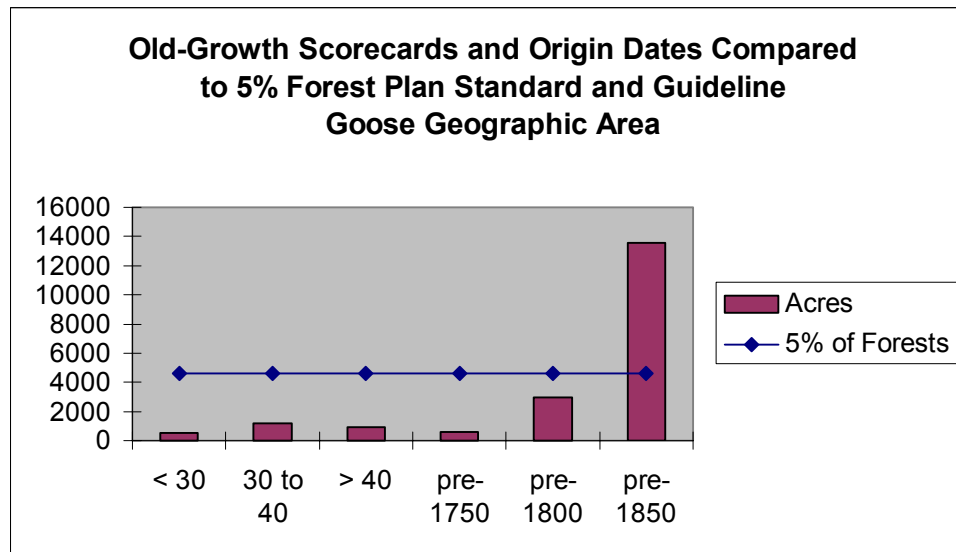
- This geographic area has huge proportions of 3B and 3C habitat structural stage. Most of this is attributable to the 1870 fire.

Concerning old-growth, approximately 4629 acres of old-growth are needed to represent 5% of the forested area in the Goose geographic area, which is the current Forest Plan minimum standard and guideline. Different measures of old-growth are listed in the following table and in Table 25:

Table 15. Old-Growth Acres

Old Growth Scorecard			Acres by Cover Type over 250 years old				Acres by Cover Type over 200 years old			
Acres <30	Acres 30-40	Acres >40	Doug-fir	Lodgepole Pine	Spruce/fir	Limber Pine	Doug-fir	Lodgepole Pine	Spruce/fir	Limber Pine
505	1207	902		239	359		48	2379	555	
			Total Acres over 250 years old: 598				Total Acres over 200 years old: 2982			

Figure 9. Old-growth Scorecards and Origin Dates



Estimate the Range of Variability in vegetative conditions

- The overall change in the relative amounts of forests to meadows in the subalpine habitat types⁸ changes very little, due to soil conditions (Despain, 1973). Thus, the current mix of 80% forest to about 10% grassland, fluctuates by no more than a few percent, with most of that being in the ponderosa pine forest type.
- Because of suppression of fires in the ponderosa pine forests along the east face of the Bighorns, it is probable that the amount of forested area has increased slightly since 1890. Since Ponderosa represents only 1% of this geographic area, this increase is almost immeasurable at the landscape scale. Assuming a fire frequency interval of 25-50 years in those forests, at least two fire occurrences have been missed, causing a slight increase in the amount of forest vs. meadow in this habitat type.
- Riparian areas may fluctuate as large, catastrophically burned areas return to a forested condition, and more water is lost to transpiration and sublimation off of the forested canopy in the winter. This would only occur in watersheds and subwatersheds that have a large percentage of the watershed burned in the same event.
- Aspen is declining for three factors:
 - Long term climatic warming since the little ice age about 10,000 years ago. There was also a relative drying of the climate since that time until the last 100 years, at which point, the climate became relatively wetter. (Knight, 1994)
 - Effects on seedling survival due to wildlife and domestic livestock grazing.
 - While the subalpine fire cycle has only marginally been affected (since this type has a fire frequency interval of 100-300 years and European man has only been suppressing fires for about 100 years), continued fire suppression will decrease the amount of aspen in the geographic area, since stand replacing fire events are regeneration events for aspen.

⁸ Subalpine habitats include lodgepole pine and Engelmann spruce forested areas. Douglas-fir and ponderosa pine forests are not included in this generalization.

Effects from air quality

There have been no studies to date on the Bighorn concerning air quality effects on plants. An applicable study from Yellowstone National Park concluded that ozone levels are suspected to be well below the level that would affect human health or vegetation.

Risks to ecological sustainability

- The cumulative effects of human intervention in the ecosystem. This includes:
 - People as vectors of exotic species. This includes plant and animal species.
 - Roads
 - Livestock and wildlife grazing and browsing
 - Timber harvest
 - Fire suppression
 - Recreation use

Describe reference conditions (landscapes)

There are no potential Research Natural Areas in this geographic area.

In the Fine Filter Analysis (Welp, et al., 2000), three areas within the geographic area were considered areas containing "... a high concentration of important taxa or representative vegetation communities." (For a complete discussion of ranking criteria, codes and descriptions, see pages 1192 to 1230 of Welp, et al., 2000):

- Big Goose Creek, B4 rank (moderate significance): Contains one plant species tracked by Wyoming Natural Diversity Database (WYNDD): *Agoseris lackschewitzii* and three animal species: common loon and the Columbia spotted and wood frogs. This site is primarily known for wood frogs. "The Bighorn mountains are one of only two mountain ranges in Wyoming with wood frogs (*Rana sylvatica*). The subpopulation that occurs in the Bighorns is morphologically distinct from other populations, although it is not yet recognized as a different taxon. [This] area contains the largest, best-quality populations currently known in this mountain range."

Part of the Big Goose site "includes" private inholdings associated with the reservoirs. The south end of the site overlaps with the Cloud Peak Wilderness Area.

- Preacher Rock Bog, B4 rank (moderate significance): This is one of the few sphagnum bogs in the Bighorn Mountains, and it contains the only Bighorn occurrences of Woodland horsetail (*Equisetum sylvaticum*) and Russet cotton-grass (*Eriophorum chamissonis*). In addition, there are three rare *Carex* sp., which are not by themselves a high conservation priority, but their unique aggregation is of interest. Labrador tea (*Ledum glandulosum*) occurs in the understory of the surrounding spruce forest, which is unusual as this species' typical range is from Alaska to southern British Columbia and Alberta (Kershaw, et al, 1998).
- Cloud Peak, B2 rank (very high significance): Contains nine species tracked by Wyoming Natural Diversity Database (WYNDD); alpine, granite, habitats are unique in the Bighorn Mountains, and are relatively undisturbed.

XI. Terrestrial Species and their Habitat

Most of the wildlife existing condition information will be presented at the Forest wide scale, since terrestrial species are rarely bounded by geographic areas. Topics included in the forest wide scale assessment include population viability, species categories (species of local concern, species at risk, etc.), and species habitats.

General Theme/Vegetation

Wildlife species composition, distribution, and abundance are determined primarily by the distribution, structure, and composition of vegetative and non-vegetative habitat components. It is assumed that managing the vegetative components within the Historic Range of Variability (HRV) would be the most beneficial for the most wildlife species. Refer to the vegetation section description of current vegetation distribution and relevance to HRV. Of concern in this area are the riparian areas and aspen stands. Aspen are at risk from a lack of disturbance and from ungulate browsing levels. Riparian areas may be at risk from livestock and wildlife grazing, dispersed recreation use, noxious weeds, and past road construction within these areas. It is assumed that priority watersheds will be identified through this process at the Forest level to prioritize any treatment or restoration activities needed relative to HRV. There are few cave or karst topography resources in this geographic area.

Viability/Species At Risk

All information relative to these species and viability concerns will be handled from a Forest wide compilation of species, recommended conservation measures, and viability assessments. Primary information for this analysis will be derived from the WYNDD database and existing literature reviews.

WYNDD Biological Areas

The areas within the geographic area identified by Wyoming Natural Diversity Database as having a high concentration of important taxa or representative vegetation communities are described within the Vegetation section. There are two biological areas within the geographic area identified as the Big Goose Creek and Preacher Rock Bog sites, noted for occurrences of sensitive amphibian and plant species. Some exclosures have been built in riparian areas to protect some of these resources from livestock and recreation impacts, and Preacher Rock Bog is entirely enclosed.

Wildlife Species Information/Recommendations

Historically, *beaver* were likely more present in the geographic area than presently occur. The species is important for shaping and maintaining riparian communities. The link to deteriorated quality and reduced presence of aspen was also noted as an important consideration for this area. Aspen habitats are frequently used by beaver for dam construction when they occur in riparian areas.

- Consider beaver as a potential focal/MIS species for this geographic area due to the habitat potential and previous use.

Elk habitat use in the geographic area would be similar to that described in the Clear/Crazy assessment. This geographic area is a major route of elk migration. In addition, there are conflicts with livestock occurring in this geographic area due to combined use of vegetative resources. In

addition, elk calving may be limited in some instances due to the conflict with livestock if livestock are present in all pastures in the spring. Issues of wildlife winter range and motorized vehicle access persist in this area, as described in the Clear/Crazy assessment. However, road access is generally less available in this area and reduces potential conflicts.

Sensitive amphibian species including the *wood frog* and the *spotted frog* inhabit wetland areas. The management of riparian areas to protect them from livestock and recreation impacts are of key concern.

XII. Cultural, Human Uses, Land Use Patterns

Recreation and Travel Management

Summary

- The Goose Creek geographic area is a popular recreation area on the Bighorn National Forest, especially for summer motorized use.
- There are few developed facilities in the geographic area.
- The Little Goose/Park Reservoir Travel Management Environmental Assessment was signed March 12, 1997 and restricted motorized travel to roads and trails on 60,000 acres in the Goose Creek and Piney/Rock geographic areas.
- The area included all of Goose geographic area from FDR 26 to the south. Approximately 12.4 miles of nonmotorized and 12 miles of motorized trails were added to the forest system of trails with the decision.

Summer travel: The Park Reservoir area provides water based recreation, especially fishing and camping. There are several lakes in the wilderness that are popular destinations, including Lake Geneva. Developed campgrounds are Little Goose, Cross Creek, Ranger Creek, East Fork and Coffeen Park. Twin Lakes is a picnic area accessed from FDR 26. Coney Creek Trailhead provides access to the wilderness.

The Red Grade Road provides access to the Goose Creek geographic area as well as FDR 26 from the west.

Spear-O-Wigwam is located south of Park Reservoir and provides cabins and horseback rides for guests. The resort is under special use permit with the Bighorn National Forest. There are nonmotorized trails near the resort open to the public and used by guests for day rides on horseback.

Winter travel: Winter recreation use is primarily snowmobiling. There are approximately twenty-two miles of state groomed snowmobile trails throughout the area. Approximately sixteen miles of trail A on FDR 26 and six miles of trail B miles are found within the analysis area.

Relationship between supply and demand of opportunities: This area will experience increasing pressure for summer use because of increasing atv use on the forest. Dispersed camping areas are sometimes crowded in the Park Reservoir area and on the road to Coffeen Park trailhead.

There is a need to provide sanitary facilities at the gravel pit at Park Reservoir, a popular day and overnight use area.

Recreation Opportunities: There are many recreation opportunities within the Goose Creek geographic area. The Forest Service describes different recreation experiences using the setting, activities and the experience. These experiences are separated in recreation opportunity spectrum (ROS) classes. The following ROS classes and acres are found within the analysis area. Table 16 shows ROS classes and acres within the analysis area.

Table 16. Recreation Opportunity Spectrum (ROS) Classes within the Goose Analysis Area

ROS class	Acres in analysis area	Percent
Primitive	23,850	20
Semi-primitive nonmotorized	39,523	34
Semi-primitive motorized	41,954	36
Roaded natural	8,668	7.5
Roaded modified	2,539	2
Rural	419	5

As displayed in table 16, fifty-four percent of the geographic area is in nonmotorized ROS classes. The wilderness accounts for thirty-one percent of this geographic area. The motorized use is concentrated in the core of the geographic area, with the more primitive ROS classes in the northern section of the geographic area and in the adjacent geographic area.

Primitive –23,850 acres

These areas are characterized by an unmodified environment and have a very high probability of experiencing solitude, freedom, closeness to nature, tranquility, self-reliance, challenge and risk. There is very low interaction between recreation users. Access and travel is nonmotorized on trails or cross-country.

Semi-primitive nonmotorized – 39,523 acres

Areas in a semi-primitive nonmotorized class are in a natural appearing environment with a high probability of experiencing solitude, closeness to nature, tranquility, self-reliance, challenge and risk. There is low interaction between users. Access and travel is nonmotorized on trails, some primitive roads or cross-country.

Semi-primitive motorized – 41,954 acres

There is a moderate probability of experiencing solitude, closeness to nature and tranquility. The setting is in a predominantly natural appearing environment. There is a low concentration of users, but often evidence of others on trails. Motorized vehicles are allowed for travel.

Roaded natural – 8,668 acres

Self-reliance on outdoor skill is of only moderate importance to the recreation user with little challenge and risk. The environment is mostly natural appearing. Access and travel is motorized including sedan and trailers.

Roaded modified – 2,539 acres

In a roaded modified setting, there is opportunity to get away from others, but with easy access. There is moderate evidence of other users on roads and little evidence of others or interaction at campsites. Conventional motorized access includes sedan, trailer, atv and motorcycle travel.

Rural – 419 acres

The opportunity to observe and affiliate with other users is important as well as convenience of facilities and recreation opportunities. There is little challenge and risk. Interaction between users may be high as is evidence of other users.

Areas of conflict: During the analysis for the Little Goose/Park Reservoir travel management plan, the 3A area near Coffeen Park was identified as an area of conflict in management with forest plan direction. There are 1,260 acres of 3A near Coffeen Park on the Tongue Ranger District. There are 1.2 miles of road in the 3A management area, semi-primitive nonmotorized recreation. The

Tongue Ranger District began a Coffeen Park 3A EA in 1998. The proposed action was to leave the road open to motorized travel and change the road corridor to a 2A management area.

The Coffeen Park road was established as a wagon road probably in the late 1890's. It was used to carry supplies and transport people to mining claims in and around Devil's Lake and along the Edleman trail up to Edleman Pass. A 1917 Forest map shows the road as a trail at that time, but the fact it was on a map reflects that it had regular use.

Coffeen Park Campground is in the 3A area. Plans for this campground were drawn and approved in 1965 and published in the Federal Register on 4/28/70. The Coffeen Park road has been used to access the campground since this time. Only the first phase out of three was completed and Coffeen Park Campground is as it was in the late 60's with few modifications. A new vault toilet was installed in 1994 as the original pit toilet was leaking, causing environmental concerns with its close proximity to East Fork of Big Goose Creek.

There was a proposal to close six campgrounds on the forest, documented in the Record of Decision for the Bighorn National Forest, signed and dated October 4, 1985. Two of the campgrounds to be closed were Coffeen Park and Cross Creek "and replaced by a new campground at Lightner Creek". Today, Coffeen Park and Cross Creek Campgrounds are in use, and there are no immediate plans for a new campground at Lightner Creek. A declining national budget and the amount of dollars available for capital improvement projects (such as the construction of a campground), and a considerable backlog of deferred maintenance on existing facilities make this endeavor infeasible at the present time.

Agreement was made during September 1997 to delay a decision on the Coffeen Pak 3A EA with the Wyoming Outdoor Council and Wilderness Watch until revision could look at the area on a landscape level.

Grazing

In 1995 the Bighorn National Forest in conjunction with the University of Wyoming Department of Renewable Resources, University of Wyoming Extension Service, and Bighorn National Forest Grazing Permittees Association developed the ***Bighorn National Forest Vegetation Grazing Guidelines***. These guidelines were revised in 1996 and finalized on April 9, 1997.

The guidelines outline vegetation-monitoring requirements for riparian areas on the Forest. This monitoring is mandatory for all allotments on the Forest with penalties established if the monitoring is not completed. The Forest rangeland management personnel spot check permittee monitoring and if discrepancies are found they are resolved on the ground or Forest Service data is used as the baseline for that season. Upland vegetative standards are outlined in the 1985 Bighorn National Forest Plan and still apply to all upland use.

Bighorn National Forest staff are in the process of completing geographic area level Allotment Management Plans (AMPs). Until the geographic area level AMPs are complete, existing AMPs will remain in affect and Annual Operating Instructions will be used to adjust the Plans to fit current resource objectives and assure management meets existing on the ground needs.

To assure objectives are being met annually the Forest Service, permittees or both complete riparian and upland monitoring. If problems occur adjustments in grazing use (changes in season of use, livestock numbers, rest periods, or deferment of on-dates) are made to allow the herbaceous vegetation to recover.

Table 17 shows selected information for the six grazing allotments in the Goose analysis area.

**Table 17. Select Information for Grazing Allotments
in the Goose Analysis Area**

Allotment	Livestock Permitted	Number Permittees	Total Acres	Capable Acres	Current AMP	Scheduled AMP Update	Permitted Season
Walker Prairie C&H	356 C/C	3	33392	3213		2006	6/25 – 10/5
Rapid Creek C&H	169 C/C	12	13920	2615		2006	6/26-9/25
Stull C&H	0	Vacant				2006	
Big Goose C&H	190 C/C	1	11196	1213		2006	7/9 – 9/20
Little Goose C&H	294 C/C	4	27680	2375		2006	7/11-9/20
Little Goose Canyon C&H	34 C/C	1	1430	270		2006	7/1 – 9/30
Willow Park C&H	91 C/C	1	6710	444		2006	7/10 – 9/15

The geographic area is scheduled for analysis in 2006. This schedule may be adjusted if current geographic areas being analyzed are delayed and target dates for completion are missed. Current delays are primarily based on the complexity of allotments in the Tongue geographic area, potential controversy of management decisions. Another factor affecting all geographic area analysis is the cultural resource surveys. The amount of area being surveyed and impacts requiring mitigation are delaying several projects.

Overall the herbaceous vegetation in the geographic area is in good condition with static to upward trends on most allotments. Isolated areas occur where vegetation use exceeds standards and guides but corrective action is normally taken the following year to allow these areas to recover. All allotments with the exception of those being analyzed with the Tongue Drainage are considered to be moving toward 1985 Forest Plan objectives. The rate of movement varies by allotment with the vegetation improving faster on some allotments than others.

XIII. Transportation System (Roads and Trails)

A Forest-wide roads analysis will be conducted during the effects analysis part of Forest Plan revision. It will be done under the 1985 Forest Plan direction. When the revised Forest Plan is implemented, the roads analysis will be reviewed and applicable revisions made.

Roads

There are currently approximately 143 miles of roads in the Goose Analysis Area. This system of roads accesses an area of approximately 183 square miles, including wilderness and private lands. The road system in this analysis area varies from high standard US Highways to primitive, abandoned wheel tracks. Table 18 gives a breakdown of roads within the analysis area.

Table 18. Miles of Road by Jurisdiction

Jurisdiction	Length (miles)
Forest Service	114.14
Unclassified	5.75
County	13.2
Other Local Highway	4.37
Private	5.8
Total:	143.3

The roads within the analysis area under Forest Service jurisdiction are divided into categories called maintenance levels. Maintenance levels range from 1-5, with 5 being the highest standard, and 1 being the lowest standard. There may also be additional roads no longer required for management purposes, or which have been created by off road vehicle use, but there still exists a road 'footprint'. These roads are called unclassified, and the mileage of these unclassified roads is an approximation. A description of maintenance levels is shown in Table 19.

Table 19. Description of Road Maintenance Levels

Maintenance Level	Description
1	Closed to public travel – can be used intermittently for management purposes.
2	Maintained for use by high clearance vehicles.
3	Maintained for use by a prudent driver in a passenger car.
4	Maintained for use by passenger cars with a moderate degree of user comfort. Usually double lane, gravel roads.
5	Maintained for a high degree of user comfort, double lane, often paved.

Figure 10 shows a breakdown of Forest Service roads within the analysis area by maintenance level, as well as other roads within the analysis area by jurisdiction.

Figure 10. Roads by Forest Service Maintenance Level and Roads by Other Jurisdiction

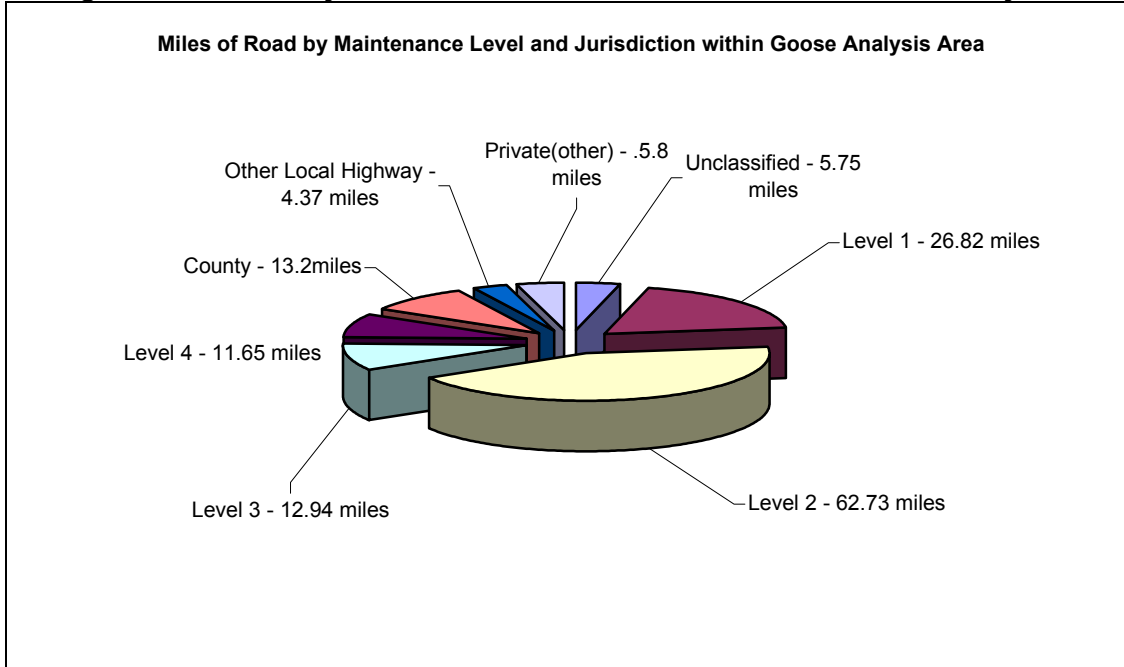


Table 20 lists the road density in the Goose analysis area. These figures do not include wilderness and private land. The open road density does not include unclassified roads.

**Table 20. Road Density in Goose Analysis Area
(National Forest System, Non-wilderness land only)**

Total Road Density	1.16 miles per square mile
Open Road Density	0.90 miles per square mile

Various structures and components are needed to manage and operate those roads under Forest Service jurisdiction. These structures include bridges, culverts, cattleguards, waterbars, rolling dips, gates, and signs. These structures along with the roads themselves represent a great investment in the transportation system, as well as a great cost for annual maintenance and, over the years, a resulting backlog of maintenance needs. Table 21 shows the breakdown of annual and deferred maintenance needs by maintenance level⁹.

Table 21. Annual and Deferred Maintenance Needs by Maintenance Level

Maintenance Level	Miles	Annual Cost/Mile	Deferred Cost/Mile
1	26.82	\$683	\$886
2	62.73	\$920	\$2,316
3	12.94	\$6,561	\$8,109
4	11.65	\$5,991	\$14,730
Total needs for annual maintenance in Goose = \$230,725			
Total needs for deferred maintenance in Goose = \$445,580			

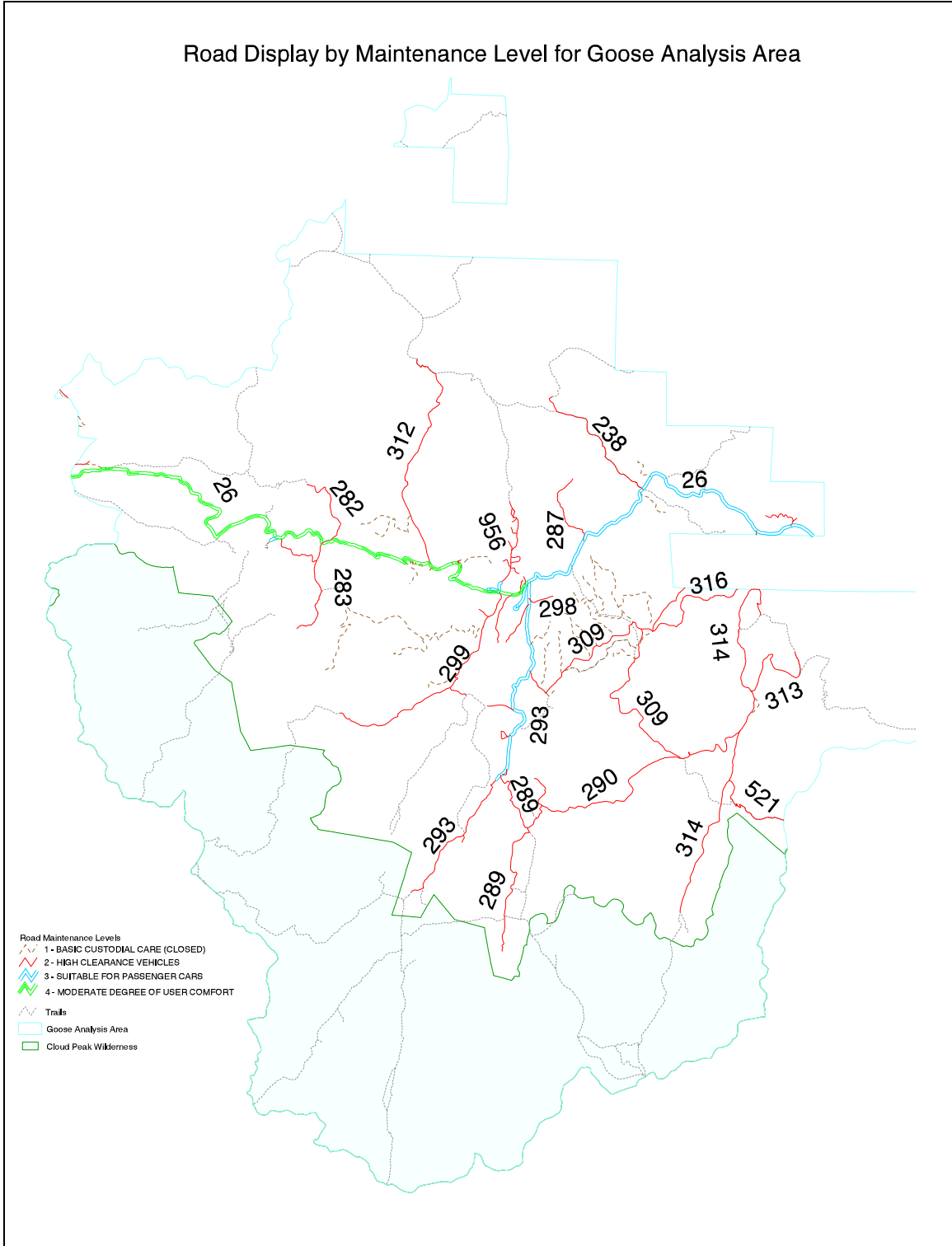
⁹ Costs arrived from performing condition surveys on each level 3, 4, and 5 road on the Bighorn National Forest in 1999, and from a random sample of level 1 and 2 roads in 2000. Costs per mile were interpolated from these surveys. Also, these costs do not reflect annual and deferred costs for bridges. Those costs are not yet readily available.

Current funding levels for road maintenance over the past 3 years have remained fairly constant, with an approximate allocation of \$460,000. This amount is far below the level needed for full implementation of the current transportation system forest wide. Current forest plan standard for full maintenance is also not being met under current allocations. Currently, general plan direction states to keep roads open to public use unless financing is not available to maintain the facility, or use is causing unacceptable damage to soil and water resources. Based on current deferred maintenance and annual maintenance needs, plan direction is not being met.

Forest Plan Goals/Desired Conditions

Forest Plan direction for road management and operations are primarily based on resource needs rather than the road systems as a separate entity. In other words, the driving force behind road management decisions are primarily based on the management directions resource needs for an area. The Forest Plan does, however, give direction that roads may be closed if financing is not available to maintain the facility, if use is causing unacceptable resource damage, if they are unsafe, or if their use conflicts with the management objectives for an area. The Forest Plan also states that arterial and collector roads shall be maintained to a minimum maintenance level of 3, and all open local roads shall be maintained to a minimum maintenance level of 2. In contrast, forest plan goals to provide additional road and trail access to the National Forest boundary are being met.

The map on page 39 shows the current Forest Service Road system by maintenance level in the Goose analysis area.



Trails

There are currently approximately 107 miles of trail in the Goose Analysis Area. This trail system accesses an area of approximately 183 square miles, including 57 square miles of wilderness. The trail system in the analysis area varies from high standard ATV trails to primitive single-track trails. The majority of the trails within the analysis area are constructed and maintained by the forest service. However, there is also a small length of trails in the analysis that are user created, or are abandoned trails that still have an existing footprint. These trails are referred to as unclassified. Table 22 shows the breakdown of classified and unclassified trails within the analysis area.

Table 22. Miles of Trail by Status in Goose

Trail Status	Length (Miles)
Forest Service	107

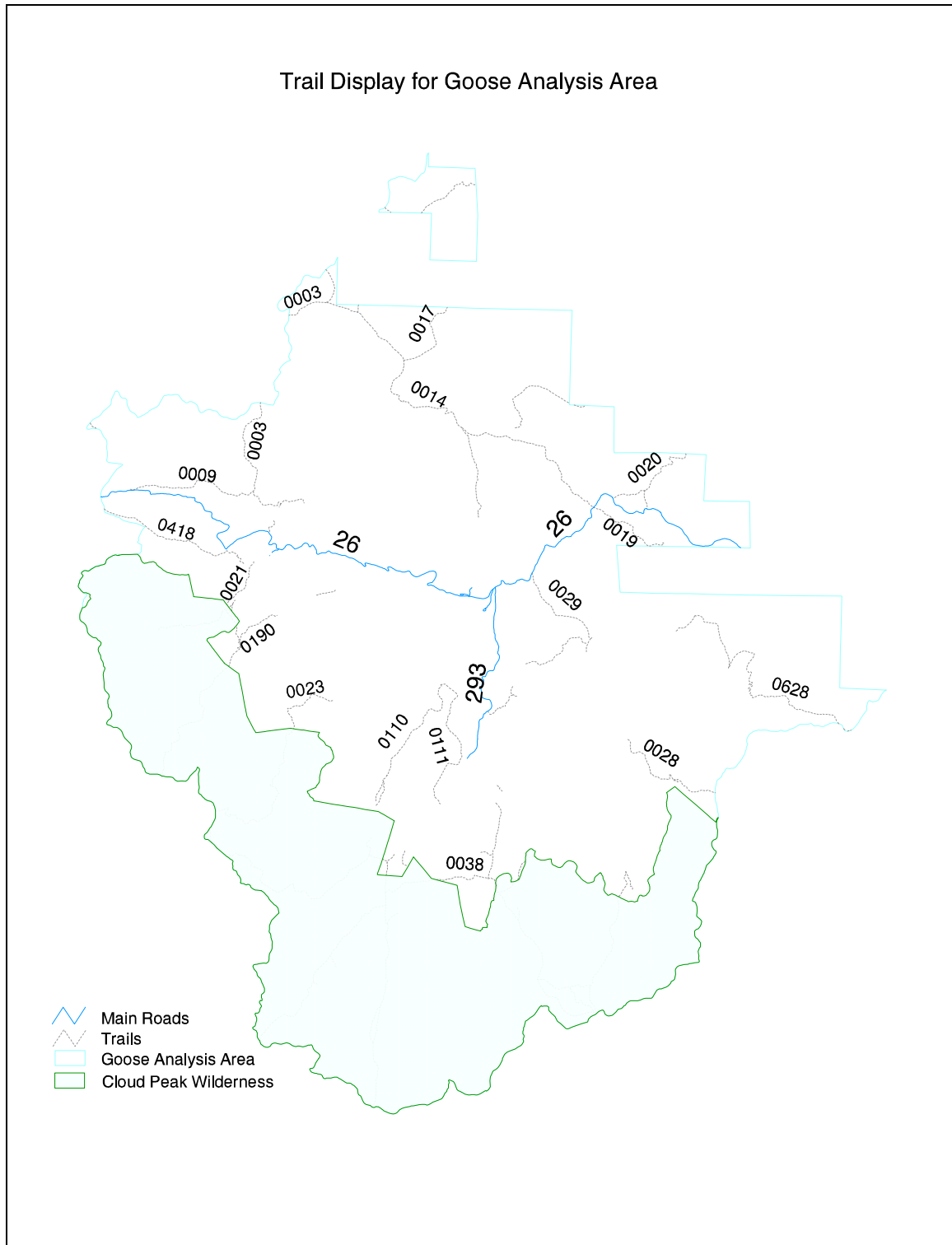
Forest Plan Goals/Desired Conditions

Forest Plan direction for transportation facilities are primarily based on resource needs rather than the road systems as a separate entity. In other words, the driving force behind road management decisions are primarily based on the management directions resource needs for an area. Currently, general plan direction states to maintain all trails to certain minimum requirements, including maintaining drainage structures to prevent unacceptable resource damage, and to remove all hazards from trails to allow safe passage for specified classes of users. For the most part, this direction of the plan is being met, however, deferred maintenance surveys have revealed that a lack of a steady budget in trail maintenance has caused some degradation of the trail system that is not consistent with current plan direction. In contrast, plan direction for providing full ranges of trail opportunities in coordination with other state, federal and county municipal jurisdictions and private industries is generally being met.

The current annual trail maintenance need is estimated to be \$1,217 per mile and deferred maintenance costs are estimated to be \$13,125 per mile¹⁰. Total trail maintenance needs in the Goose analysis area are estimated to be \$130,219 annually maintenance, with a \$2,493,750 deferred maintenance backlog.

The map on page 41 shows the current trail system within the Goose analysis area.

¹⁰ These costs are interpolated from the forest wide condition survey assessments done in 2000 and 2001.



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